

CLAIMS

1. An homogeniser for comminuting a sample of material comprising a container (1), and a grinder (20), wherein
 - 5 the container (1) comprises an interior (2) defined by sidewalls (3), an upper portion (4) having an upwardly open top communicable with an exterior of the container, and an interior bottom (5), and
 - the grinder (20) comprises
 - 10 (i) a hollow shaft (22) locatable within the container, the hollow shaft (22) defining an interior channel (23),
 - (i) a grinding head (21) provided at one end of the shaft (22),
 - (ii) at least one port (24) in the shaft (22) through which comminuted material may flow into the interior channel (23), of the shaft (22).
- 15 2. An homogeniser as claimed in claim 1 wherein the grinding head (21) comprises at least one blade.
3. An homogeniser as claimed in any preceding claim wherein the grinding head (21) is shaped to compliment the shape of the interior bottom (5), preferably wherein the
 - 20 shape is selected from the group consisting of substantially flat, substantially conical, substantially frustroconical, substantially hemispherical and substantially spherical-cap shaped.
4. An homogeniser as claimed in any preceding claim wherein the interior bottom (5) and the grinding head (21) each comprise a sample-engaging surface.
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5. An homogeniser as claimed in claim 4 wherein at least one of the sample-engaging surfaces is substantially smooth.
6. An homogeniser as claimed in any of claims 4-5 wherein at least one of the
 - 30 sample-engaging surfaces is an abrasive surface, preferably wherein the abrasive surface

comprises at least one abrasive feature selected from the group consisting of protrusions, griddles, indentations, hatching or embedded particles.

7. An homogeniser as claimed in claim 6 wherein the at least one abrasive surface
5 is integrally formed with at least one of the grinding head (21) or the interior bottom (5).

8. An homogeniser as claimed in claim 6 wherein the at least one abrasive surface
is independently formed with at least one of the grinding head (21) or the interior
bottom (5).
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9. An homogeniser as claimed in any preceding claim wherein the port (24) is
dimensioned so that only comminuted material may pass into the interior space (23) of
the shaft (22) from the container (1).

10. An homogeniser as claimed in any preceding claim wherein the port (24)
15 comprises a slit formed in the shaft (22).

11. An homogeniser as claimed in any preceding claim wherein the port (24) is
positioned on the shaft (22) proximate to the grinding head (21).
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12. An homogeniser as claimed in any preceding claim wherein there is provided a
plurality of ports (24) on the shaft (22).

13. An homogeniser as claimed in any preceding claim wherein there is provided a
25 means to reversibly close the at least one port (24).

14. An homogeniser as claimed in any preceding claim wherein the at least one port
(24) is positioned on the shaft (22) such that when the apparatus is used in combination
with a defined volume of a solution separable into at least two layers defined by
30 differing density gradients, the positioning of the at least one port permits egress of at
least one of the layers into the interior space (23) and permits the prevention of egress of
at least one of the layers into the interior space (23).

15. An homogeniser as claimed in any preceding claim wherein the upper portion of the shaft (26) is provided with an engagement means (201), the engagement means (201) providing a means of detachably engaging the shaft (22) with a rotation device (203), or a rotation device adaptor, or a closure means (204).

16. An homogeniser as claimed in claim 15 wherein the engagement means (201) comprises at least one groove, projection or indentation on the upper portion of the shaft (26).

17. An homogeniser as claimed in any of claims 15-16 wherein the engagement means (201) is shaped to complement the shape of the rotation device (203), the rotation device adaptor, or the closure means (204).

18. An homogeniser as claimed in any of claims 15-17 wherein the engagement means (201) comprises a pair of 180° helices in which the end of each helix most distal to the grinding head (21) is separated from the end of the other helix by half of the perimeter (29) of the shaft (22).

19. An homogeniser as claimed in any of claims 15-18 wherein engagement of the engagement means (201) with the rotation device (203), or the rotation device adaptor, or the closure means (204) permits movement of the rotation device (203), or the rotation device adaptor, or the closure means (204) in at least one direction to be translated into movement of the shaft (22) in the same at least one direction.

20. An homogeniser as claimed in claim 19 wherein the direction is rotational about the central axis (A) of the shaft (22).

21. An homogeniser as claimed in any of claims 15 to 20 wherein the engagement means (201) is further provided with a coupling means (202) to provide reversible and secure coupling of the shaft (22) to the rotation device (203) or to the rotation device adaptor or to the closure means (204).

22. An homogeniser as claimed in claim 21 wherein the coupling means (202) comprises a groove, projection or indentation adapted to engage with the rotation device (203) or with the rotation device adaptor or with the closure means (204) such that
5 movement of the rotation device (203), or the rotation device adaptor, or the closure means (204) in one of at least two directions is translated into movement of the shaft (22) in the same direction.
23. An homogeniser as claimed in claim 22 wherein the first of the at least two
10 directions is rotation about the shaft axis (22) and the second of the at least two directions is substantially parallel to the shaft axis (22).
24. An homogeniser as claimed in any of claims 15 to 23 wherein the closure means (204) is adapted to be securely and reversibly engagable with the engagement means
15 (201) and provide a substantially watertight seal therein.
25. An homogeniser as claimed in any of claims 15-24 wherein the closure means (204) further comprises a rotation device (203) or a rotation device adaptor.
- 20 26. An homogeniser as claimed in any preceding claim wherein the shaft (22) further comprises a biasing means for biasing the grinding head (21) against the interior bottom (5) of the container (1).
- 25 27. An homogeniser as claimed in any preceding claim wherein the grinder (20) can nest within the container (1), such that the grinding head (21) is proximate to the interior bottom (5), and a sample of comminutable material can be contained between the grinding head (21) and the interior bottom (5), and movement of the grinder (20) relative to the container results in the sample of material being comminuted.
- 30 28. An homogeniser as claimed in claim 27 wherein the grinder (20) is moveable in at least one direction chosen from rotational movement and movement in a direction substantially parallel to the central axis (A).

29. An homogeniser as claimed in any preceding claim further comprising a cap (10), wherein the cap (10) comprises a roof portion (15) and an outer skirt (14) engagable with the upper portion of the container (4) and the roof portion (15) further comprises an aperture (11) adapted to permit the shaft (22) of the grinder (20) to protrude through the aperture (11).

30. An homogeniser as claimed in claim 29 further comprising a shaft engaging means and a portion of the shaft (22) is dimensioned to be engagable with the shaft engaging means.

31. An homogeniser as claimed in claim 30 further wherein the shaft engaging means extends from the periphery of the aperture (11).

32. An homogeniser as claimed in any of claims 30-31 wherein the shaft engaging means comprises an internal continuous sidewall (12).

33. An homogeniser as claimed in any of claims 29-32 wherein the cap (10) is provided with a securing means to reversibly secure the cap to the upper portion of the container, preferably wherein the securing means is selected from at least one of the group consisting of a push-fit mechanism, a snap-lock mechanism, thread and screw arrangement,

34. An homogeniser as claimed in any of claims 29 to 33 wherein the shaft (22) is provided with a restraining means to limit the movement of the shaft (22) through the aperture (11).

35. An homogeniser as claimed in claim 34 wherein the restraining means comprises a collar (27) located on the shaft (22).

36. An homogeniser as claimed in claim 34 wherein the restraining means comprises a shoulder located on the shaft, wherein the shoulder is defined by a step-wise alteration in the radius of the shaft (22).
- 5 37. An homogeniser as claimed in any preceding claim wherein at least one of the group consisting of the homogeniser, container (1), grinder (20) or cap (10) is substantially translucent.
- 10 38. An homogeniser as claimed in any preceding claim wherein the homogeniser is substantially composed of thermoplastics or metals and is preferably machined from solid or plastic casting or metal casting or injection moulded.
- 15 39. An homogeniser as claimed in any of claims 1 to 37 wherein the homogeniser is substantially composed of glass or ceramic.
40. An homogeniser as claimed in any preceding claim wherein at least one portion of the homogeniser is composed of, impregnated with, or coated with a reactive material selected to react with a moiety intended for use within the homogeniser.
- 20 41. An homogeniser as claimed in claim 40 wherein the reactive material is adapted to adhere to biological molecules that may be found in an homogenised sample.
- 25 42. An homogeniser as claimed in any of claims 40-41 wherein the reactive material is chosen from the group consisting of at least one antibody species, at least one enzyme species, at least one biological marker species.
43. An homogeniser as claimed in any of claims 1-42 further comprising a means to aspirate the homogenate from the inner channel (23).
- 30 44. An homogeniser as claimed in any of claims 1-43 further comprising a means to dispense material into the homogeniser.

45. An homogeniser as claimed in any preceding claim further comprising a holding device.
46. An homogeniser as claimed in claim 45 wherein the container further comprises a positioning means engagable with the holding device, such that the positioning means permits the container (1) to be engaged in a specific orientation relative to the holding device.
47. An homogeniser as claimed in claim 46 wherein the positioning means is located distal to the upper portion (4).
48. An homogeniser as claimed in claim 47 wherein the specific orientation permits a defined area (100) of the container (1) to be presented to an identification reader.
49. An homogeniser as claimed in claim 48 wherein the identification reader is located on the holding device.
50. An homogeniser as claimed in any of claims 48-49 wherein the identification reader is a barcode scanner or reader of a global unique identifier.
51. An homogeniser as claimed in any preceding claim further comprising a rotation device.
52. An homogeniser as claimed in claim 55 wherein the rotation device further comprises a biasing means to provide a substantially constant force to the grinder (22) when the rotation device is engaged with the engagement means, preferably in the form of a spring.
53. An homogeniser as claimed any of claims 51-52 wherein the rotation device is either mechanically or manually operable.

54. An homogeniser as claimed in any of claims 51-53 wherein the rotation device further comprises a means to aspirate the comminuted material from the interior space (23).
- 5 55. An homogeniser as claimed in any of claims 51-54 wherein the rotation device further comprises a means to dispense material into the homogeniser.
56. An homogeniser as claimed in any of claims 45-55 wherein the holding device and rotation device are integrally formed.
- 10 57. An homogeniser for homogenising a sample of material comprising a grinder (20), wherein the grinder (20) comprises
- (i) a grinding head (21);
 - (ii) a hollow shaft (22) connected to the grinding head (21), the shaft (22) having an interior channel (23)
 - 15 (iii) at least one port (24) in the shaft (22) through which comminuted material may flow into the interior space (23) of the shaft (22).
58. A kit for homogenising a sample of material comprising a plurality of
- 20 homogenisers substantially as described in any of claims 1 to 57.
59. A kit for homogenising a sample of material comprising at least one homogeniser substantially as described in any of claims 1 to 57 and further comprising at least one of the group consisting of a rotation device, a rotation device adapter, a
- 25 closure means or a holding device.
60. A method for homogenising a sample of material comprising the use of an homogeniser as claimed in any of claims 1 to 57, and
- (i) placing the sample to be homogenised within the interior (2) of the container (1) such that it can be retained by the interior bottom (5),
 - 30 (ii) inserting the shaft (20) into the interior (2) such that the grinding head is contactable with the sample,

- (iii) placing the cap (10) on the container (1) such that the upper portion (26) of the shaft (22) extends through the aperture (11),
- (iv) engaging the engagement means (201) with the rotation device and optionally securably restraining the rotational movement of the container (1) relative to the shaft (22) optionally by means of the holding device.
- (v) homogenising the sample material by means of movement of the shaft (22) relative to the container (1),
- (vi) removing homogenised material from the interior of the container (1) into the interior space (23) of the shaft (22) by means of at least one port (24).

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61. A method as claimed in claim 60 wherein the comminuted tissue in the interior space (23) of the shaft (22) is removed from the comminuter by aspiration.

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62. Use of an homogeniser, a kit for homogenising, or method of comminuting a sample substantially as described in any of claims 1-61.

63. An homogeniser for homogenising material substantially as described herein with reference to the accompanying figures.

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64. A method for homogenising material substantially as described herein reference to the accompanying figures.